Heaven's Light is Our Guide

Rajshahi University of Engineering& Technology

Department of Electrical & Computer Engineering

Course No: ECE 4128
Course Name: Digital Signal Processing

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Experiment No: 02
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Experiment Name: Calculation and representation of linear convolution using MATLAB.

Theory: **Convolution** :

In pure mathematical terms, a convolution represents the blending of two functions, *f(x)* and *g(x)*, as one slides over the other. For each tiny sliding displacement (*dx)*, the corresponding points of the first function *f(x)* and the mirror image of the second function *g(t−x)* are multiplied together then added. The result is the convolution of the two functions, represented by the expression [*f* ∗*g*](*t*).

$$[f * g](t) = \int_0^t f(x)\, g(t-x)\, dx$$

- **Linear Convolution:**

Linear convolution is a mathematical operation done to calculate the output of any Linear-Time Invariant (LTI) system given its input and impulse response. It is applicable for both continuous and discrete-time signals.
We can represent Linear Convolution as
y(n)=x(n)*h(n)
Here, y(n) is the output (also known as convolution sum). x(n) is the input signal, and h(n) is the impulse response of the LTI system.

Software used: MATLAB

Code:

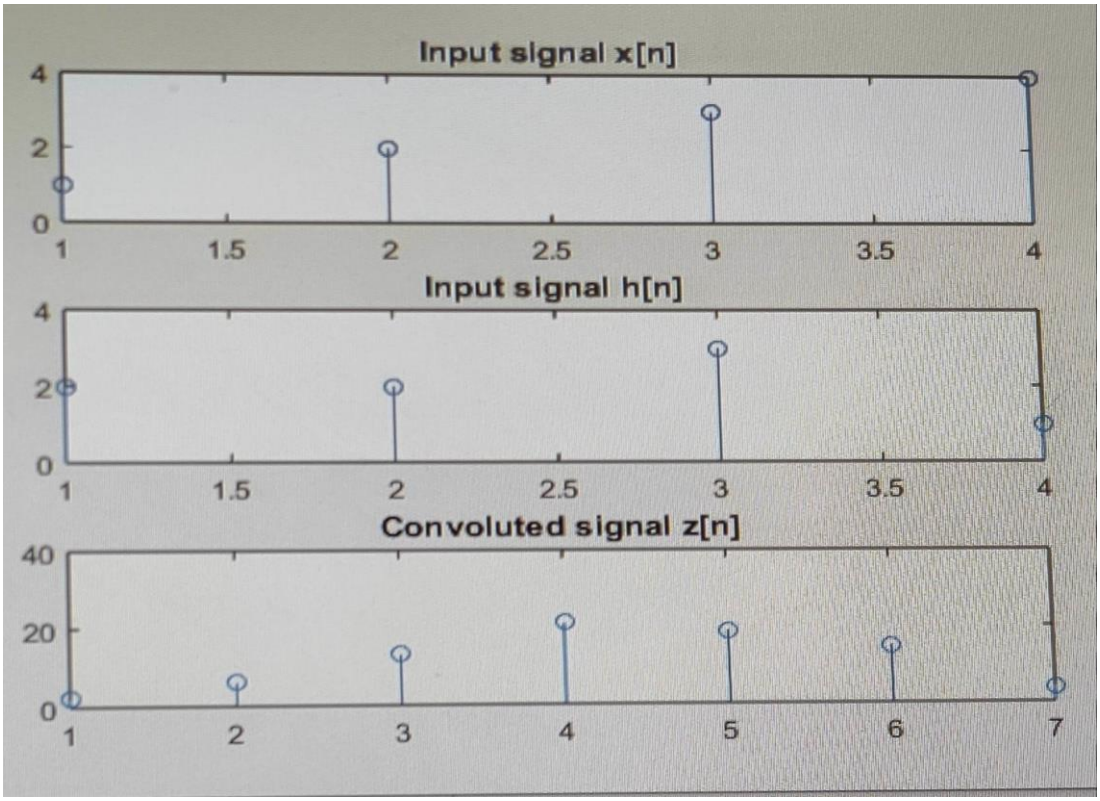
```
clc
clear all
x=[1,2,3,4];
h=[2 2 3 1];
z=zeros(1,lenght(x)+lenght(h)-1);
for n=1:lenght(z);
   for k=1:lenght(h);
      if n-k+1>0 && n-k+1<=lenght(x);
         z(n)=x(n)+h(k)+x(n-k+1);
      end
   end
end
subplot(3,1,1);
```

```
stem(x);
title('Input signal x[n]');

subplot(3,1,2);
stem(y);
title('Input signal h[n]');

subplot(3,1,3);
stem(z);
title('Convoluted signal z[n]');
```

Output:



Discussion: In this experiment ,we have experimented linear convolution by using matrix multiplication .Here,2 input signals are given-x[n] &y[n] in matrix. By multiplying these 2 matrix we got a a linear array -z[n] which represents discrete value of convoluted signal. This is executed by impulse response and summing the elements diagonally.

Conclusion: We have done the experiment successfully without any error which match with the theory of linear convolution.